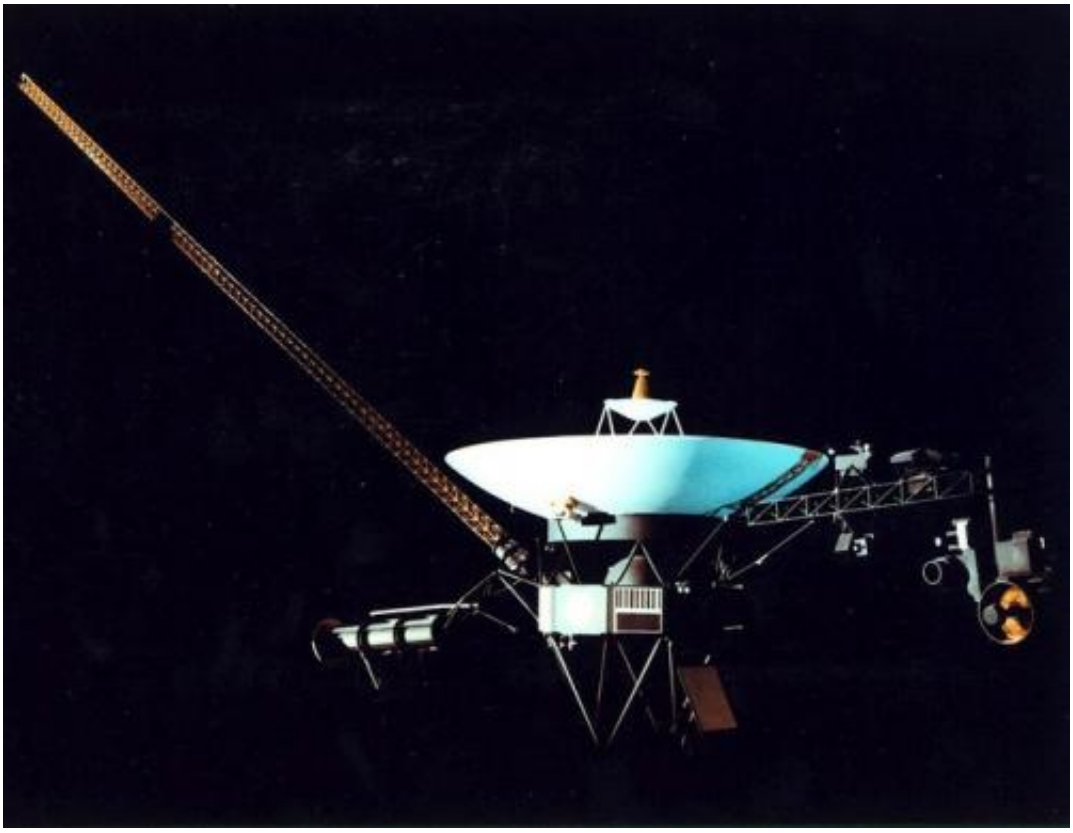
An interview with Voyager 2: At the edge of the solar system

October 17 2012, by Alice Gorman



Voyager 2. Credit: NASA

Interviewing a spacecraft isn't something one does every day. It certainly wasn't an option back in the late 1970s, when Voyager 1 and 2 set off on a mission like no other before or since: to visit some of the most mysterious planets in the solar system, and then to continue out and on,

into the galaxy.

But just recently I was lucky enough to "interview" Voyager 2, via its Twitter account, on behalf of both spacecraft.

Voyager 2 left Earth first, on August 20 1977, followed by Voyager 1 on September 5. Since then the twin spacecraft have revealed many secrets about our solar system.

Earlier this year, it looked as if Voyager 1 was about to become the first human object to ever leave the solar system. The craft was approaching the heliopause – the boundary point at which the solar wind meets the interstellar wind. But a recent study published in Nature suggests this moment may yet be some years off.

In the meantime, the spacecraft – it seems – are in good spirits.

What is your position in relation to Earth right now?

I'm about 13.5 light hours from Earth, or 14,570,000,000km. Remember, I travel about 1,300,000km each day!

I am in the southern skies, at right ascension 19h50m45.6s and declination -54°49'12" – about halfway between the stars η Ophiuchus and α Pavo.

Here's another way to think about my position. Take any sized ball (cricket, football, etc.) and hold it at a distance where it just covers the sun's disc. You now have the basis for a scale model of the solar system.

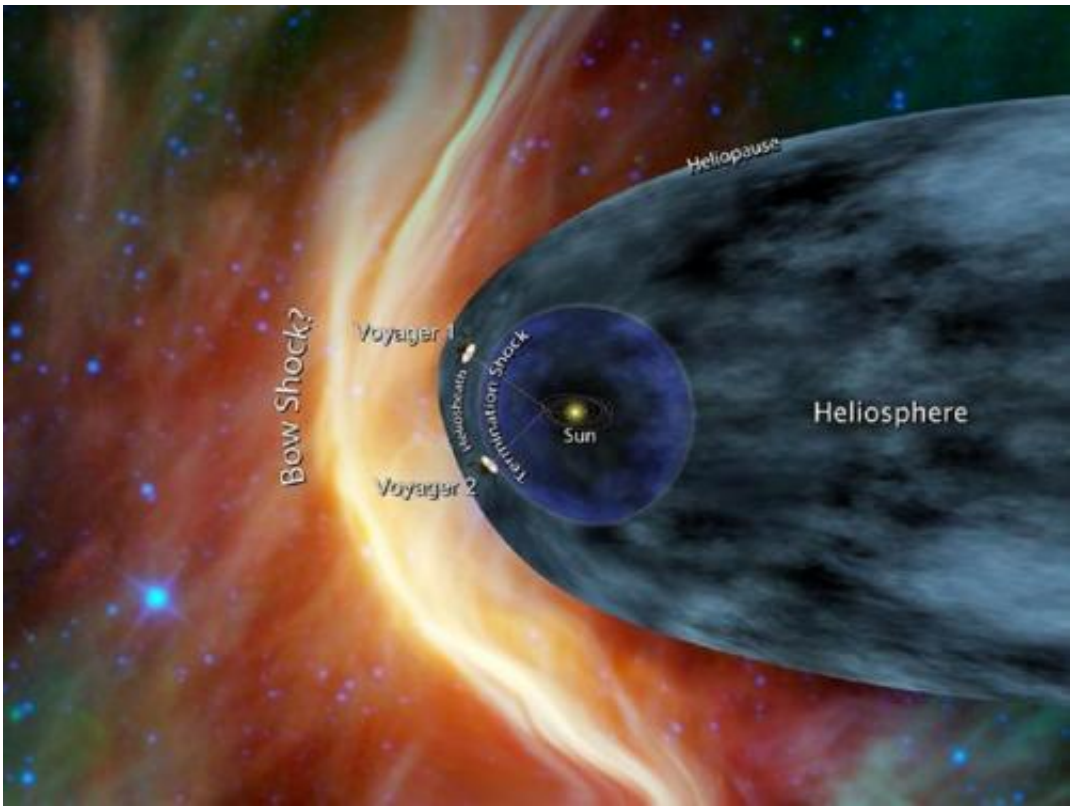
If the sun were the size of whatever ball you are using, your eyeball is now at the scaled distance of Earth, or one Astronomical Unit (AU). Using this scale, I am about 97 times as far from the ball as your eyeball.

What is the most significant thing you have taught us about the solar system?

That is a very difficult question. Most of what we know about the giant planets comes from our data. That said, later work based on the Cassini and Galileo missions has clarified several mysteries we Voyagers first uncovered.

From simple things – such as allowing better mass estimates to be calculated for the planets and their moons, and discovering new moons during every planetary encounter – to things as amazing as Io's volcanoes, Saturn's kinked rings, shepherd moons – which orbit near Saturn's rings – and ring spokes, to unexpectedly vigorous weather on Neptune.

Furthermore, no other spacecraft have tasted and bathed in the outer reaches of our solar system as Voyager 1 and I have. Without us, scientists could only speculate what it is like out here.



Credit: NASA

But I like to think of our greatest achievement as simply laying down a path that others could follow. After all, we are the very first functioning human-made objects to venture this far out from the sun, and into interstellar space!

What was it like to cross the termination shock in 2007 (the point at which the solar wind slows down to subsonic speed)?

I was elated, but also surprised. Elated, because I had to put up with Voyager 1's crowing since she crossed in 2004! Surprised, because I crossed early, at a much closer distance than Voyager 1.

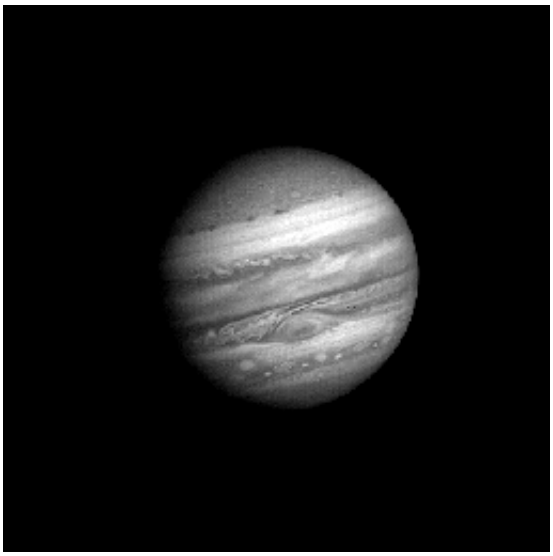
How will you know when you have crossed the heliopause and are heading into interstellar space?

Gauging from our past experiences, one indication might be our science teams' levels of confusion! Each of these crossings has had some rather unexpected features, which made the science teams very cautious about announcing definitive crossings.

For instance, the temperature of the solar wind ions (charged particles) outside the termination shock was lower than models had predicted … by a factor of ten!

More recently, Voyager 1's findings of magnetic "bubbles" was also unexpected. The models predicted a much smoother "sheet" where the flow of winds from the sun and stars was parallel, rather than the turbulent region we actually encountered.

I expect a slowing in the observed particle speeds, and changes in their directions once we reach the heliopause. Eventually this should settle down again to a smooth flow, but this time it will be a wind from stars other than the sun!



Voyager 1's approach to Jupiter over a period of more than 60 Jupiter days.

What do you remember about Earth?

I remember awakening at the Jet Propulsion Laboratory (JPL), being tested thoroughly in a very tall and white room, and then being packaged up very carefully and taken all the way across the continent to the Kennedy Space Center.

It was much more humid there, and I was tested again before I was covered up with the Titan IIIE Centaur fairing. Even though I couldn't see, I could hear. I heard all sorts of wonderful sounds: wind and rain. I remember the rain in particular.

Then, of course, I remember leaving Earth – the launch itself. It was not such a good experience, because I got very dizzy, and nearly passed out. Ground control at JPL was very worried, but I eventually calmed down and was able to let JPL know that I was fine. This was the first example of my "safing routines" coming into action.

Your fuel and power are estimated to run out around 2025. What happens then?

Actually it's just my electrical power – the fuel for adjusting my attitude (orientiation) should last past the 2030s, though I can't even access that fuel once I run out of electricity.

As my available electrical power drops, I will not have sufficient margin

to run all of my instruments at the same time and, starting in 2020, folks back on Earth will have to choose which of my instruments to keep running.

This will be done via a process very similar to that used for planning the planetary encounters, since there was a very similar set of constraints then: only a certain number of things could be done at once, and priorities had to be set well in advance so the appropriate sequences could be programmed.

This is done via a consultative process between the science and engineering teams in order to reach the best science results within the power limits.

Eventually, of course, there will be insufficient power to run any single science instrument, and the science instrument imperatives vanish. Sufficient power will remain for radio ranging for some time after that, but at this point it is unclear what, if any, science value these ranging data would have.

If you could choose a piece of music to represent what you "see" or how you feel at this point in time, what would it be?

Oh, I suppose I always go back to Thus Spoke Zarathustra (the theme tune from 2001: A Space Odyssey) because of its association with space, and especially with floating, thanks to Stanley Kubrick.

However, many of my tweeps have suggested all sorts of new music to me that I have enjoyed. Sadly, none of these newer compositions are on our golden discs, of course.

More information: *The author would like to thank Dr Paul Filmer from the National Science Foundation (US) and NASA's Jet Propulsion Laboratory (JPL) for agreeing to this interview and speaking on behalf of Voyager 2.*